



June 1989

# 5442A/DM5442A/DM7442A BCD to Decimal Decoders

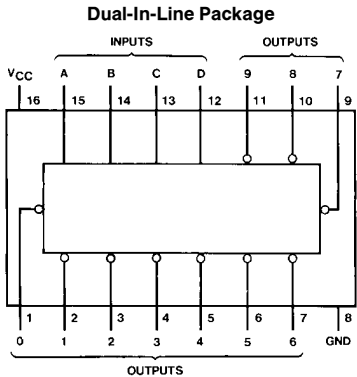
## General Description

These BCD-to-decimal decoders consist of eight inverters and ten, four-input NAND gates. The inverters are connected in pairs to make BCD input data available for decoding by the NAND gates. Full decoding of input logic ensures that all outputs remain off for all invalid (10–15) input conditions.

## Features

- Diode clamped inputs
- Also for application as 4-line-to-16-line decoders; 3-line-to-8-line decoders
- All outputs are high for invalid input conditions
- Typical power dissipation 140 mW
- Typical propagation delay 17 ns
- Alternate Military/Aerospace device (5442A) is available. Contact a National Semiconductor Sales Office/Distributor for specifications.

## Connection Diagram



Order Number 5442ADMQB, 5442AFMQB, DM5442AJ, DM5442AW or DM7442AN  
See NS Package Number J16A, N16E or W16A

## Function Table

No.	BCD Input				Decimal Output									
	D	C	B	A	0	1	2	3	4	5	6	7	8	9
0	L	L	L	L	L	H	H	H	H	H	H	H	H	H
1	L	L	L	H	H	L	H	H	H	H	H	H	H	H
2	L	L	H	L	H	H	L	H	H	H	H	H	H	H
3	L	L	H	H	H	H	H	L	H	H	H	H	H	H
4	L	H	L	L	H	H	H	H	L	H	H	H	H	H
5	L	H	L	H	H	H	H	H	H	L	H	H	H	H
6	L	H	H	L	H	H	H	H	H	H	L	H	H	H
7	L	H	H	H	H	H	H	H	H	H	H	L	H	H
8	H	L	L	L	H	H	H	H	H	H	H	H	L	H
9	H	L	L	H	H	H	H	H	H	H	H	H	H	L
I	H	L	H	L	H	H	H	H	H	H	H	H	H	H
N	H	L	H	H	H	H	H	H	H	H	H	H	H	H
V	H	H	L	L	H	H	H	H	H	H	H	H	H	H
A	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	H	H	H	L	H	H	H	H	H	H	H	H	H	H
I	H	H	H	H	H	H	H	H	H	H	H	H	H	H
D														

H = High Level  
L = Low Level

5442A/DM5442A/DM7442A BCD to Decimal Decoders

## Absolute Maximum Ratings (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	7V
Input Voltage	5.5V
Operating Free Air Temperature Range	
DM54 and 54	−55°C to +125°C
DM74	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

## Recommended Operating Conditions

Symbol	Parameter	DM5442A			DM7442A			Units
		Min	Nom	Max	Min	Nom	Max	
V <sub>CC</sub>	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub>	High Level Input Voltage	2			2			V
V <sub>IL</sub>	Low Level Input Voltage			0.8			0.8	V
I <sub>OH</sub>	High Level Output Current			−0.8			−0.8	mA
I <sub>OL</sub>	Low Level Output Current			16			16	mA
T <sub>A</sub>	Free Air Operating Temperature	−55		125	0		70	°C

## Electrical Characteristics over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = −12 mA			−1.5	V
V <sub>OH</sub>	High Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = Max V <sub>IL</sub> = Max, V <sub>IH</sub> = Min	2.4	3.4		V
V <sub>OL</sub>	Low Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = Max V <sub>IH</sub> = Min, V <sub>IL</sub> = Max		0.2	0.4	V
I <sub>I</sub>	Input Current @ Max Input Voltage	V <sub>CC</sub> = Max, V <sub>I</sub> = 5.5V			1	mA
I <sub>IH</sub>	High Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 2.4V			40	μA
I <sub>IL</sub>	Low Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V			−1.6	mA
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max (Note 2)	DM54 −20 DM74 −18		−55 −55	mA
I <sub>CC</sub>	Supply Current	V <sub>CC</sub> = Max (Note 3)	DM54 28 DM74 28	28	41 56	mA

Note 1: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

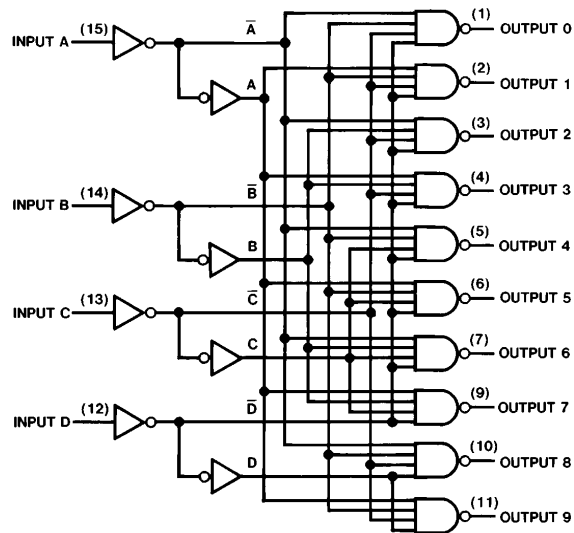
Note 2: Not more than one output should be shorted at a time.

Note 3: I<sub>CC</sub> is measured with all outputs open and all inputs grounded.

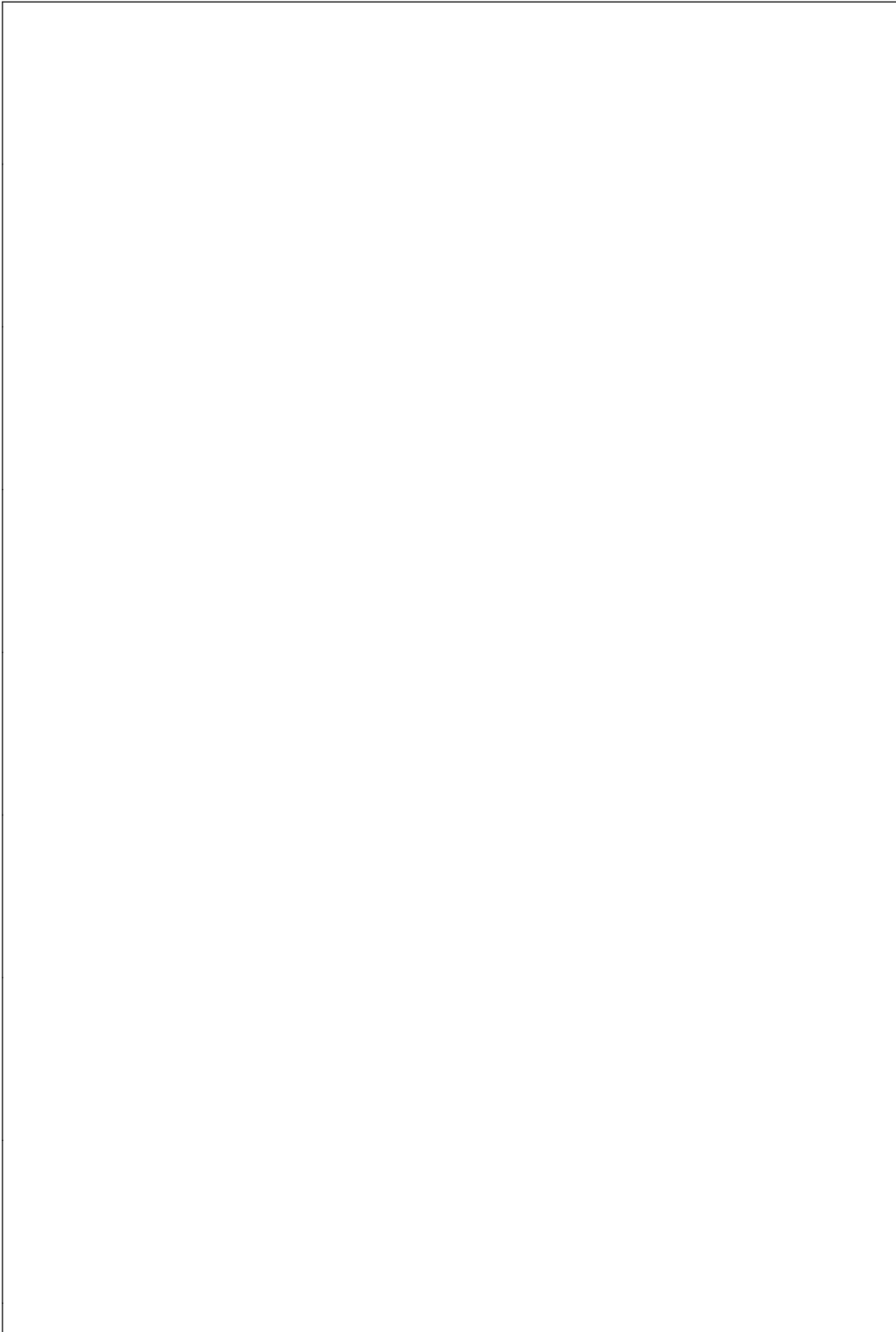
**Switching Characteristics** at  $V_{CC} = 5V$  and  $T_A = 25^\circ C$  (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	Conditions	Min	Max	Units
$t_{PHL}$	Propagation Delay Time High to Low Level Output from A, B, C or D through 2 Levels of Logic	$C_L = 15\text{ pF}$ $R_L = 400\Omega$		25	ns
$t_{PHL}$	Propagation Delay Time High to Low Level Output from A, B, C or D through 3 Levels of Logic			30	ns
$t_{PLH}$	Propagation Delay Time Low to High Level Output from A, B, C or D through 2 Levels of Logic			25	ns
$t_{PLH}$	Propagation Delay Time Low to High Level Output from A, B, C or D through 3 Levels of Logic			30	ns

**Logic Diagram**



TI/F/6516-2



The image contains three mechanical drawings of the J16A package:

- Top View:** Shows a rectangular package with 16 pins (8 on each long side). Dimensions include a total width of  $0.785 [19.94] \text{ MAX}$ , a pin pitch of  $0.025 [0.64]$ , and a pin diameter of  $0.005-0.020 \text{ TYP}$  [ $0.13-0.51$ ].
- Side View:** Shows the package height and pin dimensions. Key dimensions include a total height of  $0.220-0.310 [5.59-7.87]$ , a pin height of  $0.037 \pm 0.005 [0.94 \pm 0.13] \text{ TYP}$ , and a pin diameter of  $0.005 [0.13] \text{ MIN TYP}$ . The lead angle is specified as  $90^\circ \pm 4^\circ \text{ TYP}$ .
- Cross-sectional View:** Shows the internal structure, including the glass sealant and the lead angle of  $95^\circ \pm 5^\circ \text{ TYP}$ . Dimensions include a total length of  $0.290-0.320 [7.37-8.13]$ , a lead thickness of  $0.010 \pm 0.002 [0.25 \pm 0.05] \text{ TYP}$ , and a lead width of  $0.310-0.410 [7.87-10.41]$ .

0.740 - 0.780  
(18.80 - 19.81)

0.090  
(2.286)

0.250 ± 0.010  
(6.350 ± 0.254)

PIN NO. 1 IDENT

OPTION 01

0.130 ± 0.005  
(3.302 ± 0.127)

0.145 - 0.200  
(3.683 - 5.080)

0.020  
(0.508) MIN

0.125 - 0.150  
(3.175 - 3.810)

0.014 - 0.023  
(0.356 - 0.584) TYP

0.060  
(1.524) TYP

4° TYP OPTIONAL

90° ± 4° TYP

0.030 ± 0.015  
(0.762 ± 0.381)

0.100 ± 0.010  
(2.540 ± 0.254) TYP

0.050 ± 0.010  
(1.270 ± 0.254) TYP

INDEX AREA

PIN NO. 1 IDENT

OPTION 02

0.300 - 0.320  
(7.620 - 8.128)

0.065  
(1.651)

95° ± 5°

0.280  
(7.112) MIN

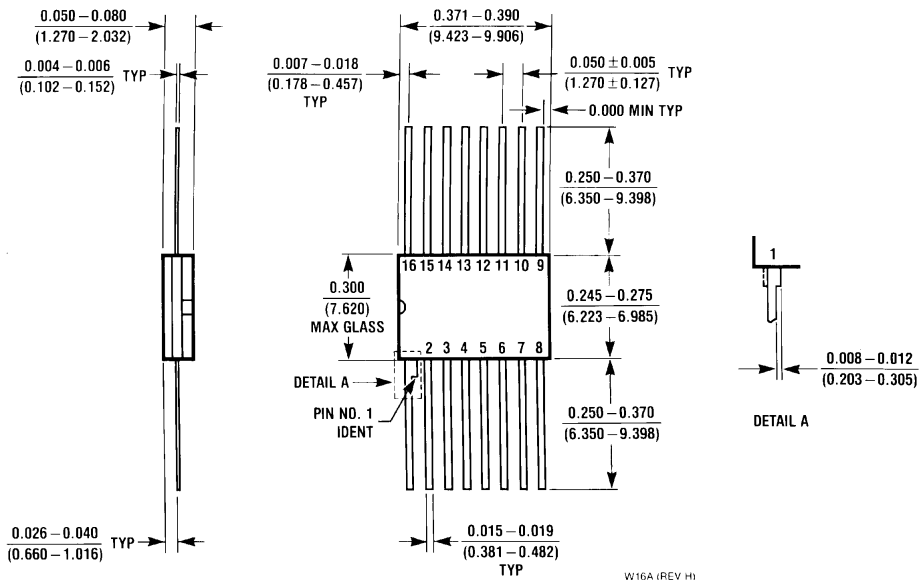
0.008 - 0.016  
(0.203 - 0.406) TYP

0.325 ± 0.040  
-0.015

0.285 ± 0.016  
-0.381

N16E (REV F)

5

**Physical Dimensions** inches (millimeters) (Continued)

**16-Lead Ceramic Flat Package (W)**  
**Order Number 5442AFMQB or DM5442AW**  
**NS Package Number W16A**

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